



## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yet-Ming Chiang et al.

Art Unit : 1796

Serial No. : 10/510,482

Examiner : Saira Bano Haider

Filed : April 19, 2005

Title : CARBON NANOPARTICLES AND COMPOSITE PARTICLES AND  
PROCESS OF MANUFACTURE**Mail Stop AF**

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Customer Service Window  
Randolph Building  
401 Dulany Street  
Alexandria, VA 22314

**DECLARATION OF JOHN VANDER SANDE UNDER 37 C.F.R. §1.132**

I, John B. Vander Sande, declare:

1. I am the Cecil and Ida Green Distinguished Professor Emeritus in the Department of Materials Science and Engineering at the Massachusetts Institute of Technology.

2. I am an inventor of the subject matter disclosed and claimed in the above-captioned application.

3. I have been investigating carbonaceous materials in detail as part of my academic research for approximately twenty years. Over the past ten years or so I have concentrated my research work on the production and characterization of fullerenes and fullerene structures produced by a combustion process. Most of this work has involved the use of transmission electron microscopy. At least twenty papers on my work in this area have appeared in the open, peer reviewed literature.

4. I have reviewed U.S. Patent No. 5,547,748 to Ruoff et al. ("Ruoff"), Valencia et al. "Understanding the stabilization of metal carbide endohedral fullerenes  $M_2C_2@C_{82}$  and related systems," *J. Phys. Chem.*, 2008, 112, 4550-4555 ("Valencia"), and Ma et al., "Processing and properties of carbon nanotubes-nano-SiC ceramic," *Journal of Materials Science* 1998, 33,

5243-5246 ("Ma"). Upon review of these references, Ruoff describes a carbon arc process where "a carbonaceous deposit forms on one of the graphite rods, from which the nanoencapsulates are recovered. A soot is also produced during the process, and when the anode rod is drilled out and packed with Gd, Gd<sub>2</sub>O<sub>3</sub> or Nd<sub>2</sub>O<sub>3</sub>, a new structure has been found in the soot" (see Ruoff, col. 10, lines 15-19). Here, as with the other descriptions of the carbon arc process described throughout Ruoff, the carbon structures are produced first, and then the metal deposits in the open structures in the carbon network.

The nanotubes described in the instant application are grown from the carbide particle directly by thermochemical means, with the carbide substrate and no other external source supplying the carbon, ensuring the true chemical bonding of the substrate and the nanotube surface layer (see specification, para. [0025]-[0028]). Indeed, in the process described by Ruoff, the order of addition of carbon and metal structures is the opposite of order in which materials are added in the process described in the instant application.

Ma describes dispersing nano-SiC powders and carbon nanotubes in butylalcohol using an ultrasonic shaker followed by hot-pressing (see Ma, Abstract). The process is a purely mechanical mixing of carbon nanotubes and SiC followed by hot-pressing. Ma makes no mention of a chemically bonded carbon nanotube covered carbide substrate. A person of ordinary skill in the art would understand that it would be impossible to modify the method disclosed by Ruoff to use the materials disclosed by Ma to form a composition including a particle including a core and a shell, the core including a metal carbide and the shell including a carbon nanotube chemically attached to at least a portion of a surface of the core, wherein the metal carbide is silicon carbide, as described in claim 1 of the instant application. As a result, the person of ordinary skill in the art would not be motivated to combine the references. Nor would the person of ordinary skill in the art have a reasonable expectation of success.

5. All statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such

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willful false statements may jeopardize the validity of the application or any patents issued thereon.

Date:

Jan. 06, 2010

John B. Vander Sande,  
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